

Review Thermal, The Atom, Nuclear

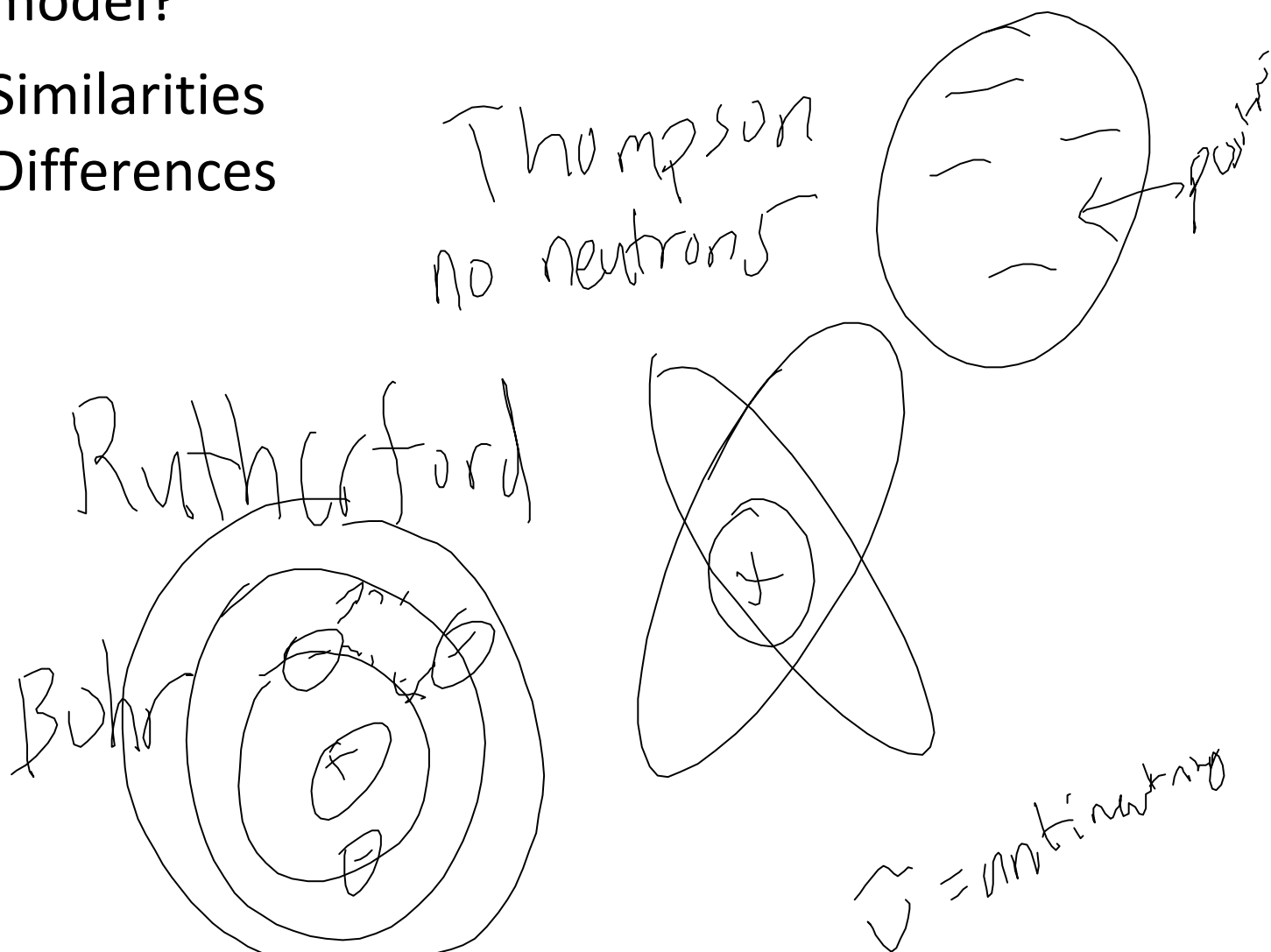
Monday, March 06, 2017 7:56 AM

The Nuclear Quiz

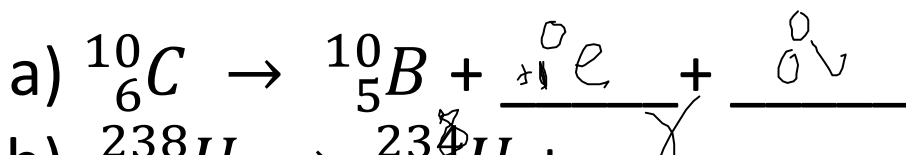
What are the similarities and difference of the Rutherford model of the atom and the Bohr model?

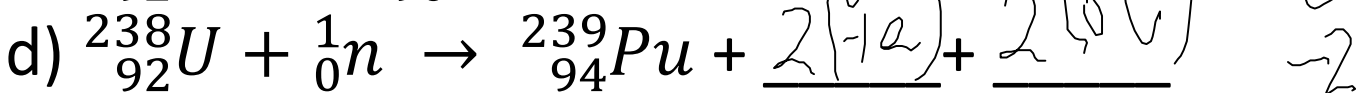
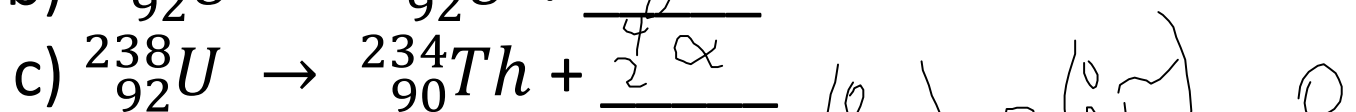
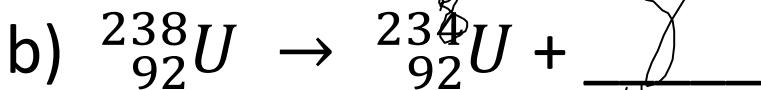
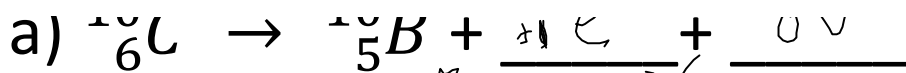
a) Similarities

b) Differences



Complete the reaction





Uranium 227 has a half-life of 1.1 minutes. If a sample has an initial activity of 3.0×10^6 decays per second, what will be the activity after:

a) 5.5 minutes?

b) 2.0 hours?

$$N = N_0 \left(\frac{1}{2} \right)^{t/t_{1/2}}$$

$$N = 3.0 \times 10^6 \left(\frac{1}{2} \right)^5 = 1.3 \times 10^5 \text{ decays/s}$$

b) $N = 3.0 \times 10^6 \left(\frac{1}{2} \right)^{120/1.1} \rightarrow 10^{-17}$

b/

$$N = 4.0 \times 10^6 \left(\frac{1}{2} \right)^{\left(\frac{120}{1.1} \right) \rightarrow 109.09} = 5.7 \times 10^{-27} \text{ decays}$$

$$\downarrow$$

$$3.0 \times 10^6 \quad \quad \quad = 4.3 \times 10^{-27} \text{ decays}$$

A muon is a subatomic particle with identical properties to an electron but with a much bigger mass, 1.88×10^{-28} kg. If a muon collides with its anti-matter particle, the anti-muon, how much energy, is released as gamma rays?

$$E = mc^2$$

$$= 2 \left(\frac{3.2 \times 10^{-27}}{1.88 \times 10^{-28}} \right) \left(3.0 \times 10^8 \frac{\text{m}}{\text{s}} \right)^2$$

$$\begin{aligned} \text{muon} &\rightarrow 338 \times 10^{-11} \\ \text{tau} &\rightarrow 5.8 \times 10^{-10} \end{aligned}$$

What is the mass defect, in units of u, and binding energy, in MeV, of Nitrogen 14, $^{14}_7\text{N}$?

The isotopic mass is 14.003074 u while the mass of a proton is 1.007825 u and a neutron is 1.008665 u.



$$8(1.007825) + 8(1.008665) = 15.9994 = 16.13192 - 13252$$

$$= 13252 \left(931.5 \frac{\text{MeV}}{u} \right)$$

$$= 123.4 \text{ MeV}$$



$$\begin{aligned} \text{Mass defect} &= -0.112356 \\ &104.7 \text{ MeV} \end{aligned}$$